PATENT APPLICATION
Docket No. 1737.2.15

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | | |
|---|---|---|---|
| Appellants: | Walter E. Red et al. | ) | |
| Serial No.: | 10/823,465 | ) | |
| Filed: | April 13, 2004 | ) | Group Art Unit: 2121 |
| Title: | SYSTEMS AND METHODS FOR CONTROLLING AND MONITORING MULTIPLE ELECTRONIC DEVICES | ) | |
| Examiner: | Jennifer L. Norton | ) | |

## APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

An Office Action dated December 10, 2009 rejected all pending claims (i.e., claims 1, 2, 4-12, 14-23 and 25-31) in the present application. A Notice of Appeal was submitted on June 9, 2010. Appellants' Appeal Brief is being filed herewith.

## 1. REAL PARTY IN INTEREST

The real party in interest is the assignee, Brigham Young University.

## 2. RELATED APPEALS AND INTERFERENCES

There are no related appeals and/or interferences.

## 3. STATUS OF CLAIMS

Claims 1, 2, 4-12, 14-23 and 25-31 are pending in the present application. Claims 1, 2, 4-12, 14-23 and 25-31 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,499,054 to Hesselink (hereinafter, "Hesselink") in view of U.S. Patent No. 6,028,412 to Shine (hereinafter, "Shine") in further view of U.S. Patent No. 6,757,247 to Zheng et al. (hereinafter, "Zheng"). Claims 3, 13 and 24 have been canceled.

Appellants appeal the rejection of claims 1, 2, 4-12, 14-23 and 25-31.

## 4. STATUS OF AMENDMENTS

No amendments were filed subsequent to the Office Action.

## 5. SUMMARY OF CLAIMED SUBJECT MATTER

The claimed invention relates generally to controlling electronic devices, and more particularly, to controlling components (e.g., valves, sensors, motors, etc.) of electronic devices. Typically, control of electronic devices occurs locally at the device with the incorporated computer or microcontroller. Control and coordination of each device is usually implemented in dedicated, single purpose hardware. Each device typically has its own microcontroller, programmable logic controller, or servo card to perform the necessary servo control. Consequently, the control loops are typically closed in the control hardware at the device itself. For example, robots, appliances, HVAC systems, TV remotes, etc., all have a resident micro or servo-controller of various sizes and complexity. These controllers are hardware dedicated to the device and generally have a limited frequency range for the device being controlled.

The purpose of the claimed invention is to avoid this type of implementation. In accordance with claim 1, the "hardware controller" (e.g., microcontroller, programmable logic controller, servo card, etc.) at the controlled device is replaced with a "dumb" state board so that the control processes can be run from a central control unit ("the host device"). In particular, as recited in claim 1, the "host device … execut[es] control software … to generate control input parameters for … controlled devices" and "send[s] the control input parameters to the … controlled devices … via … frequency-based, real-time electronic communications."

Thus, in accordance with the claimed invention, it is not necessary to build dedicated, single-purpose hardware for each controlled device. This is advantageous for many reasons. An important advantage is that costs are significantly reduced. As another example, the claimed invention provides for flexibility in altering the way in which devices are controlled. With the claimed invention, when a change is desired, software at the host device can be modified instead of having to replace the hardware controller at each controlled device. In addition, programming interfaces, control wiring, and power electronics of the controlled devices are simplified as a result of the claimed invention.

It should also be noted that the use of the term "real-time" in connection with electronic communications over a network has a specific meaning in the claims. In particular, "real-time" means the following: each device is "assign[ed] … a control frequency specific to that

controlled device," "control input parameters … are always sent to that controlled device at the assigned control frequency for that controlled device," and it is "ensur[ed] that the sum of all the control frequencies for the one or more controlled devices does not exceed the network's bandwidth."

As required by 37 C.F.R. § 41.37(c)(1)(v), a summary of claimed subject matter immediately follows. The references to the specification refer only to embodiments of the invention. The invention is defined by the claims. Accordingly, these references to the specification are not meant to limit the scope of the claims at issue in any way but are only provided because they are mandated by 37 C.F.R. § 41.37(c)(1)(v). All references are to the patent specification.

1. A method for controlling one or more electronic devices (106) through a host device (104), the method comprising:

establishing frequency-based, real-time electronic communications over a network (108) between the host device (104) and one or more controlled devices (106); (page 5, lines 26-27; page 8, lines 8-16)

assigning each controlled device (106) a control frequency specific to that controlled device (106); (page 17, lines 9-11)

executing control software (110) in the host device (104) to generate control input parameters (326) for the one or more controlled devices; (page 6, lines 8-11)

sending the control input parameters (326) to the one or more controlled devices (106), wherein the control input parameters (326) for a particular controlled device (106) are always sent to that controlled device (106) at the assigned control frequency for that controlled device (106); and (page 10, lines 5-8)

ensuring that the sum of all the control frequencies for the one or more controlled devices (106) does not exceed the network's bandwidth, so that electronic communication with each controlled device (106) always occurs at the assigned control frequency for that controlled device (106), thereby facilitating real-time communication with that controlled device (106); (page 16, lines 21-25)

wherein the one or more controlled devices (106) do not include a hardware controller for generating the control input parameters (326), but instead receive the control input parameters (326) from the host device (104) via the frequency-based, real-time electronic communications. (page 7, lines 4-6 and 9-13)

11. A computing device (104) configured for controlling electronic devices (106), the computing device (104) comprising:

a processor (634);

memory (640) in electronic communication with the processor (634); and

executable instructions executable by the processor (634), wherein the executable instructions are configured for:

establishing frequency-based, real-time electronic communications over a network (108) between the host device (104) and one or more controlled devices (106); (page 5, lines 26-27; page 8, lines 8-16)

assigning each controlled device (106) a control frequency specific to that controlled device (106); (page 17, lines 9-11)

executing control software (110) in the host device (104) to generate control input parameters (326) for the one or more controlled devices (106); (page 6, lines 8-11)

sending the control input parameters (326) to the one or more controlled devices (106), wherein the control input parameters (326) for a particular controlled device (106) are always sent to that controlled device (106) at the assigned control frequency for that controlled device (106); and (page 10, lines 5-8)

ensuring that the sum of all the control frequencies for the one or more controlled devices (106) does not exceed the network's bandwidth, so that electronic communication with each controlled device (106) always occurs at the assigned control frequency for that controlled device (106), thereby

facilitating real-time communication with that controlled device (106); (page 16, lines 21-25)

wherein the one or more controlled devices (106) do not include a hardware controller for generating the control input parameters (326), but instead receive the control input parameters (326) from the host device (104) via the frequency-based, real-time electronic communications. (page 7, lines 4-6 and 9-13)

22. A computer-readable medium for storing program data, wherein the program data comprises executable instructions for:

establishing frequency-based, real-time electronic communications over a network (108) between the host device (104) and one or more controlled devices (106); (page 5, lines 26-27; page 8, lines 8-16)

assigning each controlled device (106) a control frequency specific to that controlled device (106); (page 17, lines 9-11)

executing control software (110) in the host device (104) to generate control input parameters (326) for the one or more controlled devices; (page 6, lines 8-11)

sending the control input parameters (326) to the one or more controlled devices (106), wherein the control input parameters (326) for a particular controlled device (106) are always sent to that controlled device (106) at the assigned control frequency for that controlled device (106); and (page 10, lines 5-8)

ensuring that the sum of all the control frequencies for the one or more controlled devices (106) does not exceed the network's bandwidth, so that electronic communication with each controlled device (106) always occurs at the assigned control frequency for that controlled device (106), thereby facilitating real-time communication with that controlled device (106); (page 16, lines 21-25)

wherein the one or more controlled devices (106) do not include a hardware controller for generating the control input parameters (326), but instead receive the control input parameters (326) from the host device (104) via the frequency-based, real-time electronic communications. (page 7, lines 4-6 and 9-13)

## 6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The following issues are presented for review:

A. Whether claims 1, 2, 4-12, 14-23 and 25-31 are unpatentable under 35 U.S.C. § 103(a) over Hesselink in view of Shine in further view of Zheng.

## 7. ARGUMENT

### A. Claims 1, 2, 4-12, 14-23 and 25-31 Rejected under 35 U.S.C. § 103(a)

Claims 1, 2, 4-12, 14-23 and 25-31 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hesselink in view of Shine in further view of Zheng. This rejection is respectfully traversed.

The factual inquiries that are relevant in the determination of obviousness are determining the scope and contents of the prior art, ascertaining the differences between the prior art and the claims in issue, resolving the level of ordinary skill in the art, and evaluating evidence of secondary consideration. KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 406 (2007) (citing Graham v. John Deere Co. of Kansas City, 383 U.S. 1, 17-18 (1966)). As the Board of Patent Appeals and Interferences has recently confirmed, "obviousness requires a suggestion of all limitations in a claim." In re Wada and Murphy, Appeal 2007-3733 (citing CFMT, Inc. v. Yieldup Intern. Corp., 349 F.3d 1333, 1342 (Fed. Cir. 2003)).

Claims 1, 2, 5-12, 14-23 and 25-31

Claim 1 will be discussed initially.

Hesselink, Shine and Zheng all fail to teach or suggest that "the one or more controlled devices do not include a hardware controller for generating the control input parameters, but instead receive the control input parameters from the host device via the frequency-based, real-time electronic communications," as recited in claim 1. This is acknowledged by the Examiner in the Office Action. (*See* Office Action, page 3, line 16; page 4, lines 4-7; page 5, lines 1, 4-5 and 10-11.)

However, the Examiner asserts that "[i]t would have been obvious ... since it has been held that omission of an element[] *and its function* in a combination where the [remaining] elements perform the same functions as before involves only routine skill in the art." (Office Action, page 5, lines 12-17; emphasis added.) Appellants strongly disagree. This is not a situation where "an element *and its function[s]*" are being omitted, as asserted by the Examiner. Rather, an element (the "hardware controller") is being omitted, but its functions are being

performed by another element (the "host device via the frequency-based, real-time electronic communications"). Furthermore, there are several advantages to the elimination of the hardware controller at the controlled device, which the Examiner appears to be ignoring.

Typically, control of electronic devices is implemented in dedicated, single purpose hardware. Each device typically has its own microcontroller, programmable logic controller, or servo card to generate control input parameters and perform the necessary servo control. The purpose of the claimed method is to avoid this type of implementation. In accordance with claim 1, the "hardware controller" (e.g., microcontroller, programmable logic controller, servo card, etc.) at the controlled device is replaced with a "dumb" state board so that the control processes can be run from a central control unit ("the host device"). In particular, as recited in claim 1, the "host device … execut[es] control software … to generate control input parameters for … controlled devices" and "send[s] the control input parameters to the … controlled devices … via … frequency-based, real-time electronic communications."

The method of claim 1 – in which it is not necessary to build dedicated, single-purpose hardware for each controlled device – is advantageous for many reasons. An important advantage is that costs are significantly reduced. As another example, the method of claim 1 provides for flexibility in altering the way in which devices are controlled. With the method of claim 1, when a change is desired, software at the host device can be modified instead of having to replace the hardware controller at each controlled device. In addition, programming interfaces, control wiring, and power electronics of the controlled devices are simplified as a result of the method of claim 1.

Eliminating the need to build dedicated, single-purpose hardware for each controlled device is not simply a matter of "omi[tting] … an element and its function[s]," as asserted by the Examiner. Rather, it represents a fundamental change to the way that electronic devices are controlled. The method of claim 1 is clearly not obvious in view of the teachings of Hesselink, Shine and Zheng.

In addition, Hesselink, Shine and Zheng all fail to teach or suggest "establishing frequency-based, real-time electronic communications over a network between the host device and one or more controlled devices," as recited in claim 1.

Appellant acknowledges that Hesselink uses the term "real-time." However, the term "real-time" has a different meaning in claim 1 than it has in Hesselink. Hesselink's use of the term "real-time" is not used appropriately in the context of frequency-based servo-control, but more accurately represents current or near-time. Hesselink's control network uses the conventional TCP/IP protocol. (*See* Hesselink, col. 4, lines 56-60.) A network that uses conventional TCP/IP is not a real-time network in the sense of controlling critical time dependent processes where the communication cycle must be exact and unvarying, as in controlling valves, sensors, motors, etc.

In claim 1, "real-time" means the following: each device is "assign[ed] … a control frequency specific to that controlled device," "control input parameters … are always sent to that controlled device at the assigned control frequency for that controlled device," and it is "ensur[ed] that the sum of all the control frequencies for the one or more controlled devices does not exceed the network's bandwidth." The Examiner acknowledges that Hesselink does not teach or suggest these requirements. (*See* Office Action, page 3, line 17 – page 4, line 1.) If Hesselink does not teach or suggest these requirements, then Hesselink does not teach or suggest "real-time electronic communications" within the meaning of claim 1.

Shine also does not teach or suggest all of the requirements for "real-time electronic communications" within the meaning of claim 1. In particular, Shine does not teach or suggest "ensuring that the sum of all the control frequencies for the one or more controlled devices does not exceed the network's bandwidth," as required by claim 1. The Examiner correctly acknowledges this in the Office Action. (*See* Office Action, page 5, lines 1 and 4-5.)

Zheng does not make up for the deficiencies of Hesselink and Shine. The Examiner asserts that "Zheng teaches to ensuring that the sum of all the control frequencies for the one or more controlled devices does not exceed the network's bandwidth." (Office Action, page 5, lines 6-7.) Appellants respectfully disagree.

Zheng does not teach or suggest anything at all about "control frequencies," as that term is used in claim 1. In claim 1, the term "control frequencies" has a very specific meaning. In particular, claim 1 relates generally to "controlling … electronic devices through a host device." This is accomplished, in part, by "assigning each controlled device a control frequency specific

to that controlled device," and "sending … control input parameters to the … controlled devices, wherein the control input parameters for a particular controlled device are always sent to that controlled device at the assigned control frequency for that controlled device." Zheng, however, does not have anything to do with "controlling … electronic devices through a host device." Instead, Zheng relates generally to "transmission of data between endpoints in a ring network over virtual circuits," and more specifically, to methods for "determining how to control the generation of connections in the ring network." (Zheng, col. 1, lines 41-44.) Figure 1 of Zheng shows "a closed-loop, ring network that is formed by a unidirectional connection of network elements $NE_1$ through $NE_N$." (Zheng, col. 3, lines 46-48.) Zheng's network, however, does <u>not</u> include a "host device and one or more controlled devices," as recited in claim 1. Because Zheng does not have anything to do with "controlling … electronic devices through a host device," then it logically follows that Zheng also does not teach or suggest anything at all about "control frequencies," as that term is used in claim 1. Zheng certainly does not teach or suggest "ensuring that the sum of all the control frequencies for the one or more controlled devices does not exceed the network's bandwidth," as recited in claim 1.

The Examiner also asserts that "Zheng teaches … facilitating real-time communication with that controlled device." (Office Action, page 5, lines 6-8.) Appellants respectfully disagree. As discussed above, Zheng does not have anything to do with "controlling … electronic devices through a host device." Thus, there is not a "controlled device" in Zheng. Moreover, Zheng does not teach or suggest anything at all about "facilitating real-time communication" of any sort. The term "real-time" is not used anywhere in Zheng.

For at least the foregoing reasons, Appellants respectfully submit that claim 1 is allowable. In addition, claims 2, 5-12, 14-23, and 25-31 are allowable for at least the same reasons.

Claim 4

Hesselink, Shine and Zheng all fail to teach or suggest that "the control frequency is assigned using a $2^N$ time slicing algorithm, … wherein each control frequency that is assigned has a value of $2^N$, further comprising establishing real-time electronic communications with a plurality of controlled devices and assigning a discrete control frequency for each controlled device using the $2^N$ time slicing algorithm," as recited in claim 4. The Examiner correctly acknowledges that Hesselink does not teach or suggest this claimed subject matter. (Office Action, page 7, lines 4-8.) However, the Examiner asserts that this claimed subject matter is taught by Shine. Appellants respectfully disagree.

Shine teaches the use of $2^N$ frequencies for comparing accumulated frequencies to desired frequencies, because bitwise comparisons are simplified using multiples of 2 in integrated circuits. However, Shine does not teach or suggest that the "control frequency" that is "assign[ed]" to a controlled device is "assigned using a $2^N$ time slicing algorithm," as required by claim 4. Shine also does not teach or suggest the control of "a plurality of controlled devices" from one host device at the same time with the devices having differing control frequencies (i.e., "a discrete control frequency for each controlled device"). Shine also does not teach or suggest that only frequencies of value $2^N$ are generated, or that the devices to be controlled must operate at only frequencies specified by $2^N$, as required by claim 4 ("assigning a discrete control frequency for each controlled device using the $2^N$ time slicing algorithm").

The Examiner does not assert that Zheng teaches or suggests that "the control frequency is assigned using a $2^N$ time slicing algorithm, … wherein each control frequency that is assigned has a value of $2^N$, further comprising establishing real-time electronic communications with a plurality of controlled devices and assigning a discrete control frequency for each controlled device using the $2^N$ time slicing algorithm," as recited in claim 4. Nor can Appellants find any part of Zheng that teaches or suggests this claimed subject matter.

For at least the foregoing reasons, Appellants respectfully submit that claim 4 is allowable.

Respectfully submitted,

/Thomas M. Hardman/

Thomas M. Hardman
Reg. No. 51,777
Attorney for Applicant

Date: August 7, 2010

AUSTIN RAPP & HARDMAN
170 South Main Street, Suite 735
Salt Lake City, Utah 84101
Telephone: (801) 931-5475

## CLAIMS APPENDIX

**Listing of Claims involved in the appeal:**

1. A method for controlling one or more electronic devices through a host device, the method comprising:

establishing frequency-based, real-time electronic communications over a network between the host device and one or more controlled devices;

assigning each controlled device a control frequency specific to that controlled device;

executing control software in the host device to generate control input parameters for the one or more controlled devices;

sending the control input parameters to the one or more controlled devices, wherein the control input parameters for a particular controlled device are always sent to that controlled device at the assigned control frequency for that controlled device; and

ensuring that the sum of all the control frequencies for the one or more controlled devices does not exceed the network's bandwidth, so that electronic communication with each controlled device always occurs at the assigned control frequency for that controlled device, thereby facilitating real-time communication with that controlled device;

wherein the one or more controlled devices do not include a hardware controller for generating the control input parameters, but instead receive the control input parameters from the host device via the frequency-based, real-time electronic communications.

2. The method of claim 1, further comprising receiving, at the host device, output parameters from the controlled devices in response to the control input parameters.

4. The method of claim 1, wherein the control frequency is assigned using a $2^N$ time slicing algorithm, where N is a non-negative integer, wherein each control frequency that is assigned has a value of $2^N$, further comprising establishing real-time electronic communications with a plurality of controlled devices and assigning a discrete control frequency for each controlled device using the $2^N$ time slicing algorithm, where N is a non-negative integer.

5. The method of claim 4, wherein N is independently determined for each controlled device of the plurality of the controlled devices.

6. The method of claim 4, wherein the $2^N$ time slicing algorithm comprises assigning the control frequency at $2^N$ hertz, where N is a non-negative integer that will yield a discrete control frequency in proximity to a preferred control frequency of each controlled device.

7. The method of claim 1, further comprising initiating a control loop process on the host device when electronic communication is established with a controlled devices.

8. The method of claim 1, further comprising accessing the host device from a remote computing device via the Internet.

9. The method of claim 8, further comprising providing information relating to the controlled devices to a user at the remote computing device.

10. The method of claim 9, further comprising receiving user input at the host device from the user at the remote computing device, wherein the input relates to the controlled devices.

11. A computing device configured for controlling electronic devices, the computing device comprising:

a processor;

memory in electronic communication with the processor; and

executable instructions executable by the processor, wherein the executable instructions are configured for:

establishing frequency-based, real-time electronic communications over a network between the host device and one or more controlled devices;

assigning each controlled device a control frequency specific to that controlled device;

executing control software in the host device to generate control input parameters for the one or more controlled devices;

sending the control input parameters to the one or more controlled devices, wherein the control input parameters for a particular controlled device are always sent to that controlled device at the assigned control frequency for that controlled device; and

ensuring that the sum of all the control frequencies for the one or more controlled devices does not exceed the network's bandwidth, so that electronic communication with each controlled device always occurs at the assigned

control frequency for that controlled device, thereby facilitating real-time communication with that controlled device;

wherein the one or more controlled devices do not include a hardware controller for generating the control input parameters, but instead receive the control input parameters from the host device via the frequency-based, real-time electronic communications.

12. The computing device of claim 11, wherein the executable instructions are also configured for receiving, at the computing device, output parameters from the controlled devices in response to the control input parameters.

14. The computing device of claim 11, wherein the control frequency is assigned using a $2^N$ time slicing algorithm, where N is a non-negative integer, wherein each control frequency that is assigned has a value of $2^N$, wherein the executable instructions are also configured for establishing real-time electronic communications with a plurality of controlled devices and assigning a discrete control frequency for each controlled device using the $2^N$ time slicing algorithm, where N is a non-negative integer.

15. The computing device of claim 14, wherein N is independently determined for each controlled device of the plurality of controlled devices.

16. The computing device of claim 14, wherein the $2^N$ time slicing algorithm comprises assigning the control frequency at $2^N$ hertz, where N is a non-negative integer that will yield a discrete control frequency in proximity to a preferred control frequency of the controlled device.

17. The computing device of claim 11, wherein the executable instructions are also configured for initiating a control loop process on the computing device when electronic communication is established with a controlled device.

18. The computing device of claim 17, wherein the executable instructions are also configured for initiating a torque/current control loop process at a microcontroller on the controlled device when the controlled device comprises a motor.

19. The computing device of claim 11, wherein the executable instructions are also configured for accessing the computing device from a remote computing device via the Internet.

20. The computing device of claim 19, wherein the executable instructions are also configured for providing information relating to the controlled devices to a user at the remote computing device.

21. The computing device of claim 20, wherein the executable instructions are also configured for receiving user input at the computing device from the user at the remote computing device, wherein the input relates to the controlled devices.

22. A computer-readable medium for storing program data, wherein the program data comprises executable instructions for:

establishing frequency-based, real-time electronic communications over a network between the host device and one or more controlled devices;

assigning each controlled device a control frequency specific to that controlled device;

executing control software in the host device to generate control input parameters for the one or more controlled devices;

sending the control input parameters to the one or more controlled devices, wherein the control input parameters for a particular controlled device are always sent to that controlled device at the assigned control frequency for that controlled device; and

ensuring that the sum of all the control frequencies for the one or more controlled devices does not exceed the network's bandwidth, so that electronic communication with each controlled device always occurs at the assigned control frequency for that controlled device, thereby facilitating real-time communication with that controlled device;

wherein the one or more controlled devices do not include a hardware controller for generating the control input parameters, but instead receive the control input parameters from the host device via the frequency-based, real-time electronic communications.

23. The computer-readable medium of claim 22, wherein the executable instructions are also configured for receiving, at the computing device, output parameters from the controlled device in response to the control input parameters.

25. The computer-readable medium of claim 22, wherein the control frequency is assigned using a $2^N$ time slicing algorithm, where N is a non-negative integer, wherein each control frequency that is assigned has a value of $2^N$, wherein the executable instructions are also configured for establishing real-time electronic communications with a plurality of controlled devices and assigning a discrete control frequency for each controlled device using the $2^N$ time slicing algorithm, where N is a non-negative integer.

26. The computer-readable medium of claim 25, wherein N is independently determined for each controlled device of the plurality of controlled devices.

27. The computer-readable medium of claim 25, wherein the $2^N$ time slicing algorithm comprises assigning the control frequency at $2^N$ hertz, where N is a non-negative integer that will yield a discrete control frequency in proximity to a preferred control frequency of the controlled device.

28. The computer-readable medium of claim 22, wherein the executable instructions are also configured for initiating a control loop process on the computing device when electronic communication is established with a controlled device.

29. The computer-readable medium of claim 22, wherein the executable instructions are also configured for accessing the computing device from a remote computing device via the Internet.

30. The computer-readable medium of claim 29, wherein the executable instructions are also configured for providing information relating to the controlled devices to a user at the remote computing device.

31. The computer-readable medium of claim 30, wherein the executable instructions are also configured for receiving user input at the computing device from the user at the remote computing device, wherein the input relates to the controlled devices.

## EVIDENCE APPENDIX

NONE.

## RELATED PROCEEDINGS APPENDIX

NONE.